

**Technical Guide to**

**CNI-930M**

**( Two Way Messenger )**

**CNI Inc.**

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<b>1. Overview</b>	<b>3</b>
<b>2. Specification and features</b>	<b>3</b>
<b>A.Environment</b>	<b>3</b>
<b>B.General RF specifications</b>	<b>3</b>
<b>C.Radio interface</b>	<b>3</b>
<b>D.Transmitter</b>	<b>4</b>
<b>E.Receiver</b>	<b>4</b>
<b>3. Circuit guide</b>	<b>5</b>
<b>4. Antenna Specification</b>	<b>10</b>
<b>5.Duty cycle</b>	<b>16</b>

## 1. Overview

CNI-930M, TWMB3(Two Way Messenger), is a **digital** data communication equipment in accordance with Mobitex specification. The frequency it uses ranges from 896Mhz to 901Mhz for transmission and from 935MHz to 941MHz for reception.

TWMB3 enables you to **make data communication in two-way**, and it also helps you to enjoy various types of data services with **full mobility due to support for roaming**.

With **high-resolution graphic LCD display**, you can **manipulate various types of information to communicate with others in many ways**.

- **Basic specification**

- Dimension : 106(L) X 68(W) X 19(H) mm
- Weight : 145g
- Supply voltage : Main 4.2V (Li-Ion)  
Sub 2.4V(Ni-MH) or 3V(Alkaline), AAA size 2cell
- RF protocol : **Mobitex**
- Host protocol : **MASC**

## 2. Specification and features

### A. Environment

- Operation temperature: -30℃ ~ +60℃
- Storage temperature : -35℃ ~ +80℃
- Humidity : **normal operation after 8 hours storage in 95% non-condensed**

### B. General RF specifications

- Modulation : GMSK
- Mode : **half-duplex**
- Bit rate : 8,000bps

### C. Radio interface

- Channel spacing : 12.5KHz
- Bandwidth : 10KHz

**D. Transmitter**

- Frequency : 896 ~ 901 MHz
- Transmit power (MAX Power : 2W)

Roaming Value dB $\mu$ V (RV)	Output-Power W(dBm)
RV<30	2.00W $\pm$ 2dB(33dBm)
30 $\leq$ RV<36	0.5W $\pm$ 2dB(27dBm)
36 $\leq$ RV<42	0.125W $\pm$ 2dB(21dBm)
42 $\leq$ RV<50	0.03W $\pm$ 2dB(15dBm)

- Frequency stability :  $\pm 1.5$ ppm
  - Modulation stability :  $\pm 5\%$
  - FM deviation : 2.0KHz  $\pm$  0.1KHz (Logic '1')  
-2.0KHz  $\pm$  0.1KHz (Logic '0')
  - Harmonic and Spurious Emission :  $\leq -56$ dBc(Portable)  
 $\leq -60$ dBc(Mobile)
  - Output Power in carrier off : 0.25 $\mu$ W(-36dBm)
  - Spurious RF Radiation Carrier Off
    - :  $\leq -60$ dBm (896 ~ 901MHz band)
    - :  $\leq -80$ dBm (935 ~ 941MHz band)

**E. Receiver**

- Frequency : 935 ~ 941MHz
- Sensitivity :  $\leq -115$  dBm (<1% BER )
- Adjacent Channel Rejection : > 55dB
- Out-of-Band Rejection (fo  $\pm 1$  to 10MHz) : > 60dBc
- Image frequency rejection : > 45dBc

### 3. Circuit guide

#### A. RF circuit

CNI-930M circuit consists of five parts, each of which is power supply, antenna, synthesis/modulation of frequency, transmission and reception.

##### ① Power supply

Power supply is composed of voltage regulator and switching part. Voltage regulator generates 3V of power supplied from VBB when the control of RF\_EN switch is turned on.

When RF\_EN is high, RF\_VCC is regulated with 3V, and RF\_VCC is supplied to PLL IC, VCTCXO, OP-Amp, VCO, and Drive Amp.

When RX\_EN is low, RX\_VCC is turned on by switching TR for RX, and RX\_VCC (3V) is supplied to LNA, MIXER, IF AMP and IF IC.

When TX\_EN is low, TX\_VCC is turned on by switching TR for TX, and TX\_VCC (3V) is supplied to Buffer Amp and OP-Amp.

The switch between TX mode and RX mode can be achieved by control of RX\_EN and TX\_EN.

##### ② Antenna

Antenna part is composed of antenna matching circuit, BPF, and RX/TX signal isolation circuit.

CNI-930M adapts  $\lambda/4$  retractable antenna to match to mid range frequency of communication. (refer to Antenna Specification)

TX/RX signal isolation circuit isolates signals of communication and is composed with switching diode and inductor.

The signals received from antenna meet the send/receive path and then switching diode is turned on and the signals proceed only to receiving path. In receiving mode, signals from TX Power Amp can not go through RX path because switching diode is off.

### ③ Frequency synthesizer and modulator

Frequency synthesizer consists of PLL part, VCO module and pre-modulation filter. The PLL part is composed of phase detector, loop filter, and 12.6Mhz VCTCXO

VCO module generates 896~901Mhz frequencies in accordance with the voltage which is from charge pump of PLL to loop filter. Programmable Divider in PLL makes the VCO output frequency to any channel value according to the frequency data from Logic CPU. Phase detector gets low and high frequencies from comparison of phase. Loop filter filters the frequencies to get a value of voltage. The voltage is input to VCO to achieve phase lock process.

Modulation is completed when modem IC signal of Logic part is input to VCO and authorized.

### ④ Receiver

Receiver filters and amplifies RF signal through SAW filter and LNA.

RX part is double super heterodyne type, and consists of LNA, LPF, Mixer, SAW filter and IF IC part. There happens RX signal from antenna and the signal is low-noise-amplification(LNA) through SAW filter and LNA, and it comes to 2nd IF 455KHz via 2nd X-TAL(39.545MHz).

SAW filter rejects Image frequency( $RX \pm 2*IF$ ) generated from 1'st Mixer while receiving. For example, if the input channel is 939MHz, the output frequency would be 40MHz from mixer while local frequency is 899MHz. But if SAW filter will not filter the image frequency of  $899 \pm 2*IF$ , S/N would be worse with 40MHz( $899-859=40$ ) of noise. And SAW filter should filter to prevent local frequency becoming spurious through LNA and reverse path.

LNA amplifies and sends the faint signal from antenna to mixer, and mixer TR mixes and generates 1st IF with frequency from antenna.

IF comes from mixer, and IF contains inter-modulation product component. MCF removes that product component. So clean IF(40MHz) can be inserted to IF IC. 2nd local frequency entered IF IC is mixed with the IF(40MHz) signal to be 2nd IF of

455KHz simultaneously.

2nd IF signal of 455KHz passes LPF(Ceramic filter) to remove the noise, and the signal is de-modulated with discriminator method. Here detected RF signal entered into receiver and RSSI signal which indicates the strength, and they are passed to micro processor in analogue value.

## ⑤ Transmitter

Transmitter consists of driver amp and power amplifier, and TX power control. It generates carrier frequency while share RX with frequency synthesizer.

Local frequency is used to direct transmission frequency because there is difference between transmission and reception. So it only amplifies and propagates through PA(Power Amp.) which can get high level of gain easily with low power.

## B. LOGIC Circuit

### ① Summary

This unit consists of CPU part, memory part, IO part, modem part, and power supply part.

### ② CPU part

The CPU adopted by this unit has 16/32-bit ARM7TDMI RISC processor (66MHz) and works on 20.48MHz. The main functions are as follows;

- Execute MASC protocol
- Control PLL circuit of RF part and perform Power Saving function
- Perform Data transaction function( receiving and transmitting) through Data Pump(Modem) part
- Checking and processing of RSSI Level come from RF part
- Perform Data transaction with DTE through DTE interface part

### ③ Memory part

Memory part consists of FLASH Memory (16Mb, IC2) and DRAM(16Mb, IC6). Flash Memory stores LLI information and program. And SRAM supplies memory stacks for program.

**④ IO Part**

Input Part is consists of

- Touch PAD Interface adopted touch panel enables user's graphic data input
- side SLIDE Key
- side ESC Key

Output Part is consist of

- Screen Display Part with 160\*240 pixel, legible high resolution display screen, all kind of information composed of characters and graphics can be caught by simple glance of look
- front top dual mode LED operation control signal of CPU.

**⑤ Modem Data Pump**

Modem part is in charge of MASC protocol , and transmits two way Data between CPU and RF part. The main functions are as followings :

- Packet Data Framing
- GMSK Data Modulation
- FEC Encoding/Decoding
- Interleaving/De-interleaving

**⑥ POWER Supply Part**

Power Supply part converts external Power source, VBB to 3V which is needed for internal operation.

**⑦ Screen Display Part**

With 240 X160 pixel, legible high resolution display screen, all kinds of information composed of characters and graphics can be caught by simple glance of look. And adopted touch panel enable user's graphic data input.





#### 4. Antenna Specification

**Product Name :** Retractable ANT of 900MHz Range

**MODEL :** HR-809

**Manufacturer :** ACE ANTENNA Corp.

① **Application**

This specification describes  $\lambda/4$  WHIP ANTENNA used for frequency range of 900MHz for transmission DATA of wireless.

② **Conditions of using Antenna**

Handheld  
  Fixed  
  Mobile  
  Outdoor  
  Indoor  
  Others

③ **Antenna type**

Extendable with  $\lambda/4$  Helical over  $\lambda/4$  WHIP.

④ **Electrical features and Performance**

Item	Features/Performance	Remark
Frequency range	910 ~ 914 MHz	
Nominal impedance	50 $\Omega$	
V.S.W.R	Less Than 1.9:1 (Extended ) Less Than 1.9:1 (Retractable )	

Radiation Pattern	Omni-direction	
Polarization	Vertical	
Gain	0±1dBi(Unity)	

**⑤ Structural Specification**

Item	Specification/Features	Remark
Connector Type	SCREW	
Total length	95 ± 0.5mm	

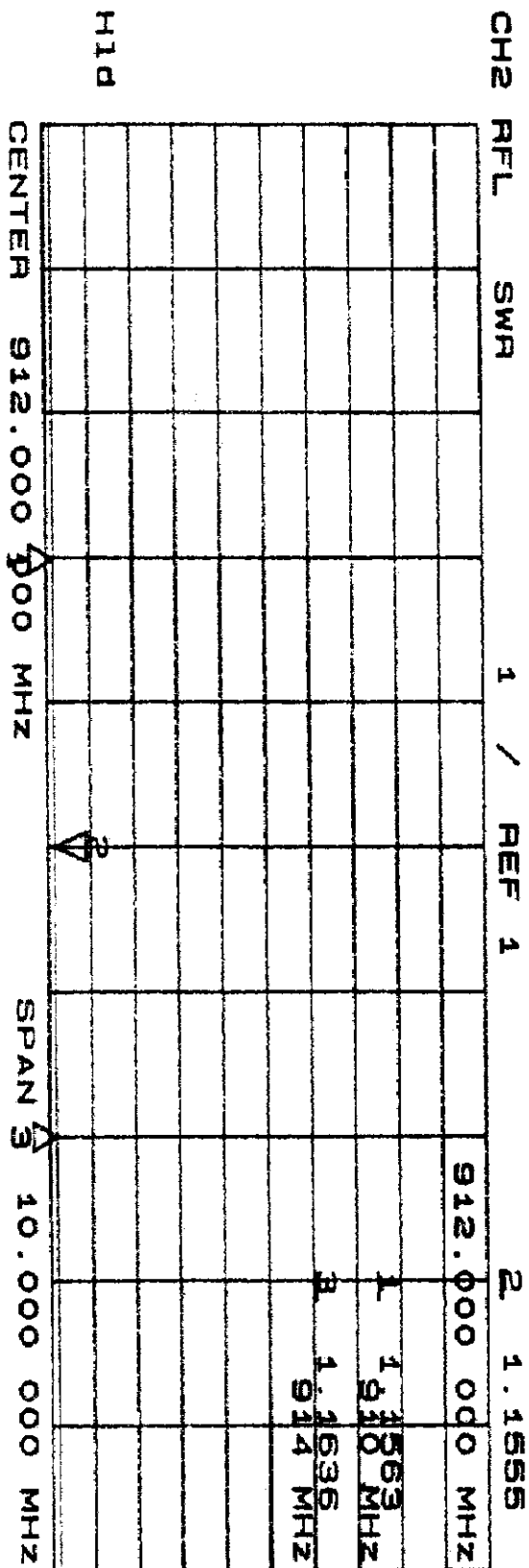
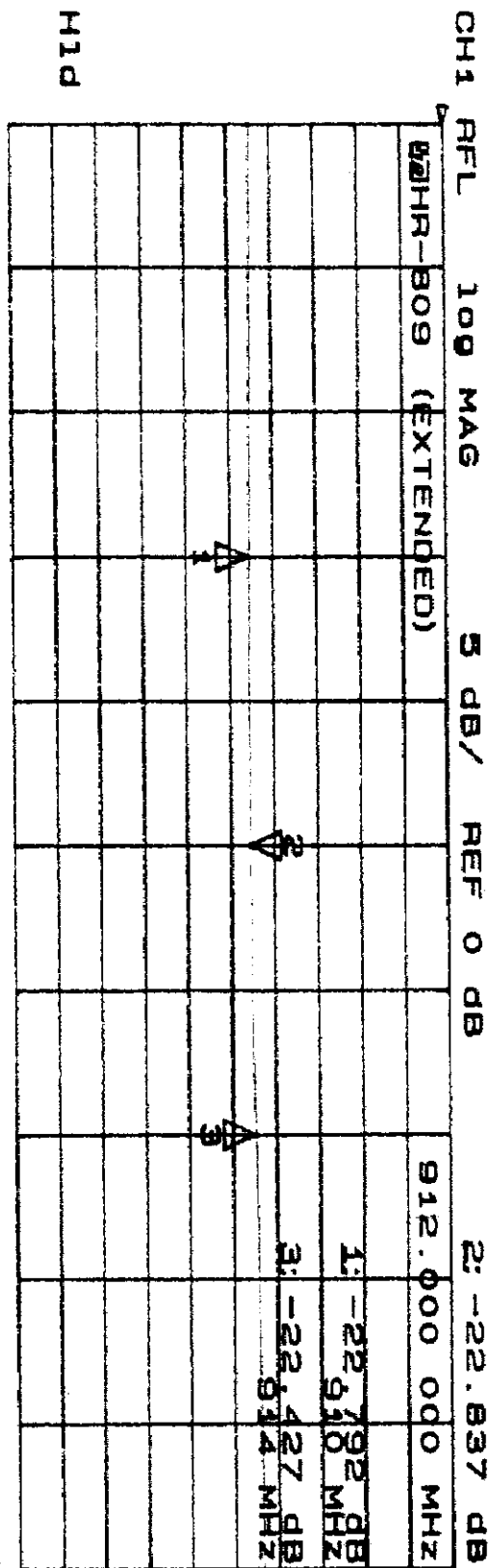
**⑥ Other features and performance**

**A. Temperature**

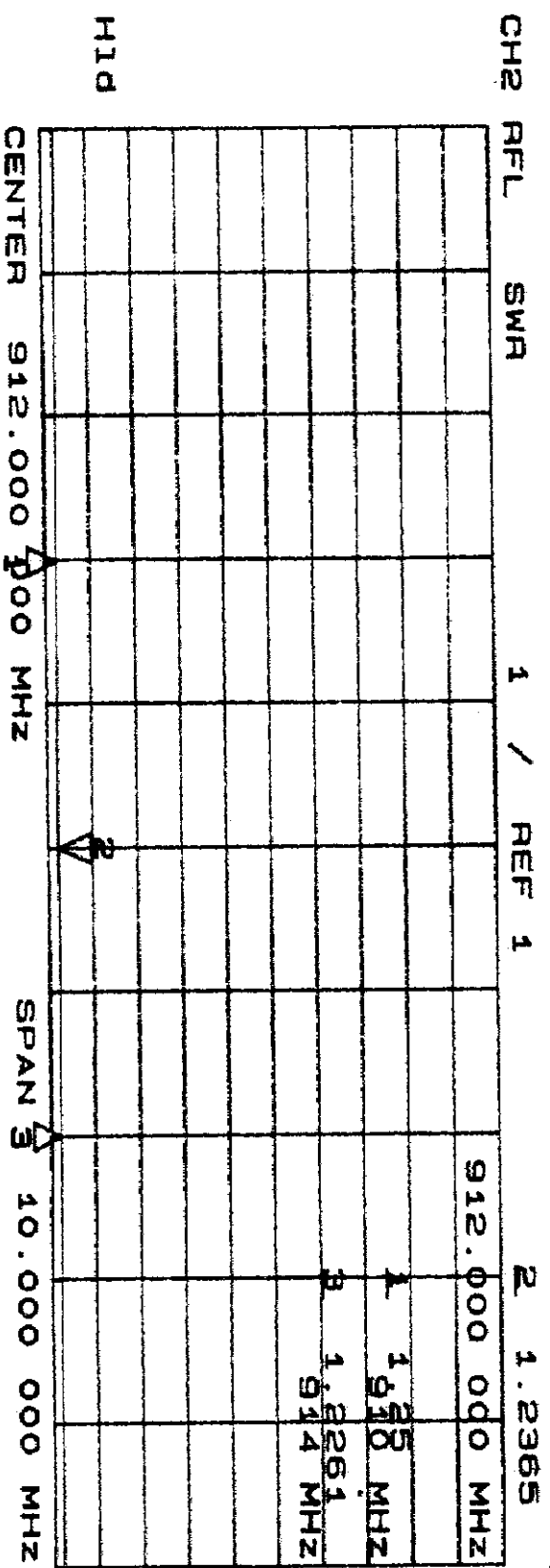
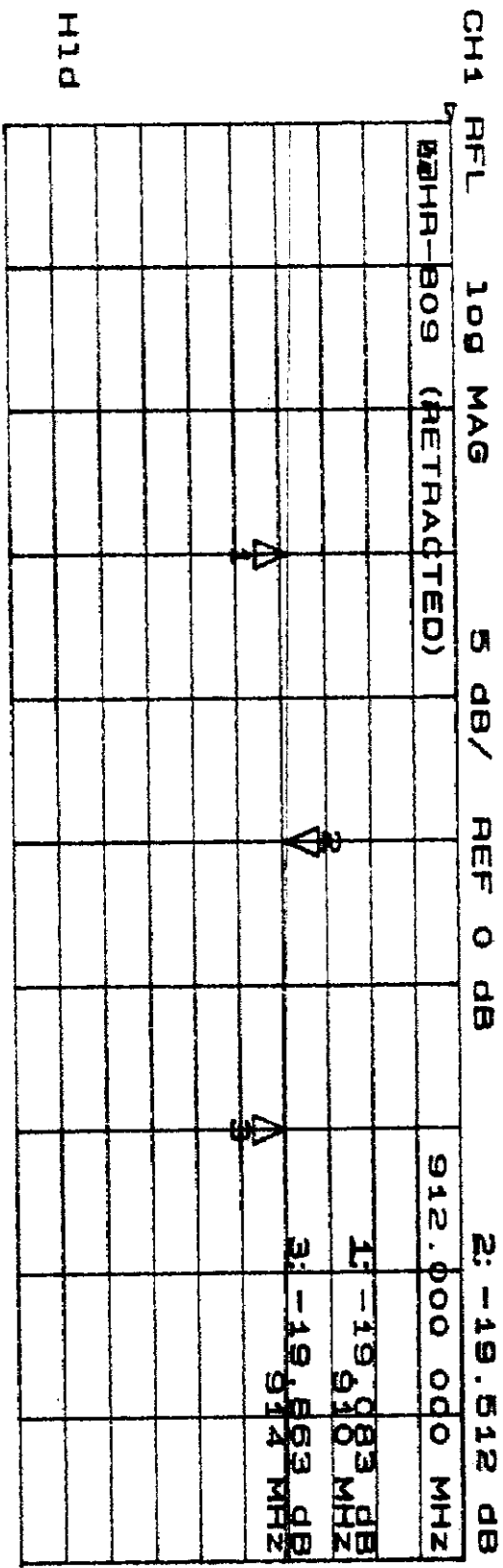
Antenna shall not be deformed or damaged and shall satisfy "Clause 4" in this specification after Placing Antenna at -30°C and 60°C for 96 hours.

**B. Humidity**

After placing Antenna at surrounding temp. 40°C with relative humidity of 90 ~ 95 for 96 hours, antenna shall not be deformed or damaged, and shall satisfy "Clause 4" in this specification













than 8.13% (26 seconds). Then the packet transmission will be confirmed and transmitted immediately. However, if the duty factor is more than the limit, the packet transmission will be delayed until confirmation. In the figure, the duty factor calculated within window frame(1) is more than 26 seconds so that the packet cannot be transmitted immediately. The packet will be delayed until new window frame is calculated and calculated duty factor is evaluated to be less than 8.13% which is like the case of window frame(2).

As convenience, the above explanation does not include the time between confirmation to actual transmission which is like sync search time etc.. Every time factor that affects duty factor calculation will be considered in the device to be marked.